NGST

Next Generation Space Telescope

Advanced Mirror System Demonstrator Pre-Solicitation Briefing

Albuquerque, New Mexico

January 13, 1999

AMSD as a Pathfinder for NGST

Raison d'Etre

- **Cast the Net Widely...**
  - *Ensure that we have multiple technology pathways through NMSD and AMSD to facilitate decision making in 2001*
- **Fast Cycle Times**
  - *Emphasize that you generally can't produce things faster without changing your processes*
- **Cost as an Independent Variable (CAIV)**
  - *Encourage the designers and manufactures to factor in the cost of a material or process step early*
  - *Elucidate the cost function for the product at the end*
- **System Robustness**
  - *Encourage the design of products that scale easily and degrade gracefully*
  - *Use process pathfinders as checkpoints along the way to ensure manufacturability*
- **Effective Teaming**
  - *Leads should team with your suppliers and outsource things you aren't good at*

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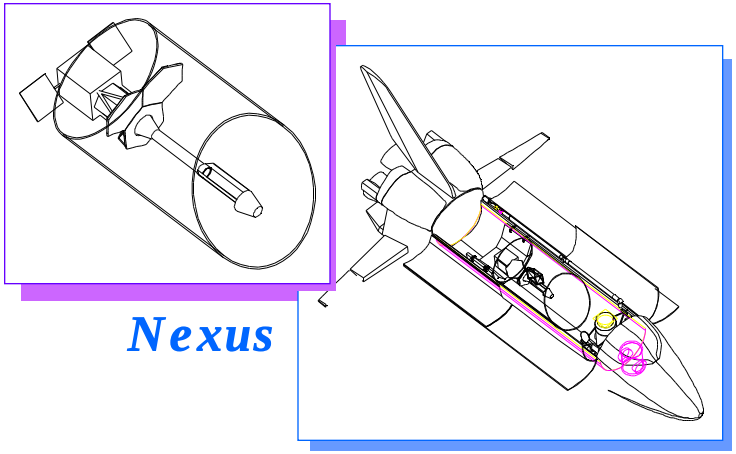
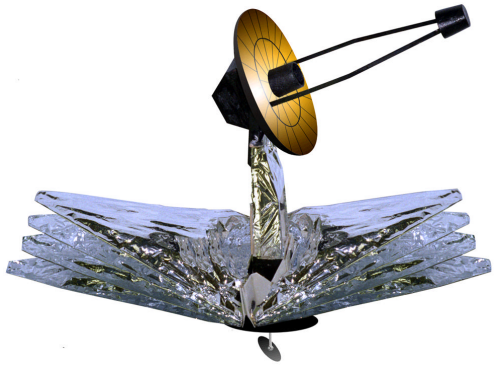
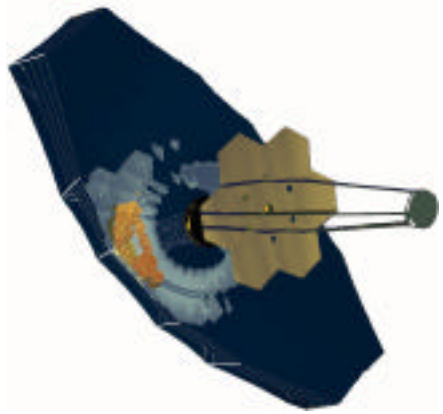


Nexus



Why is AMSD so Important to NGST?



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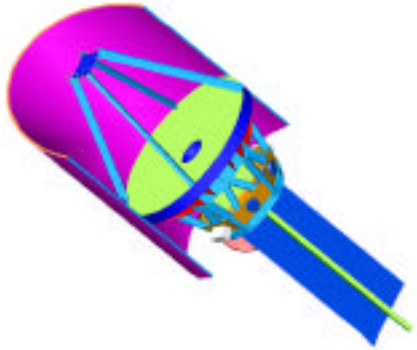

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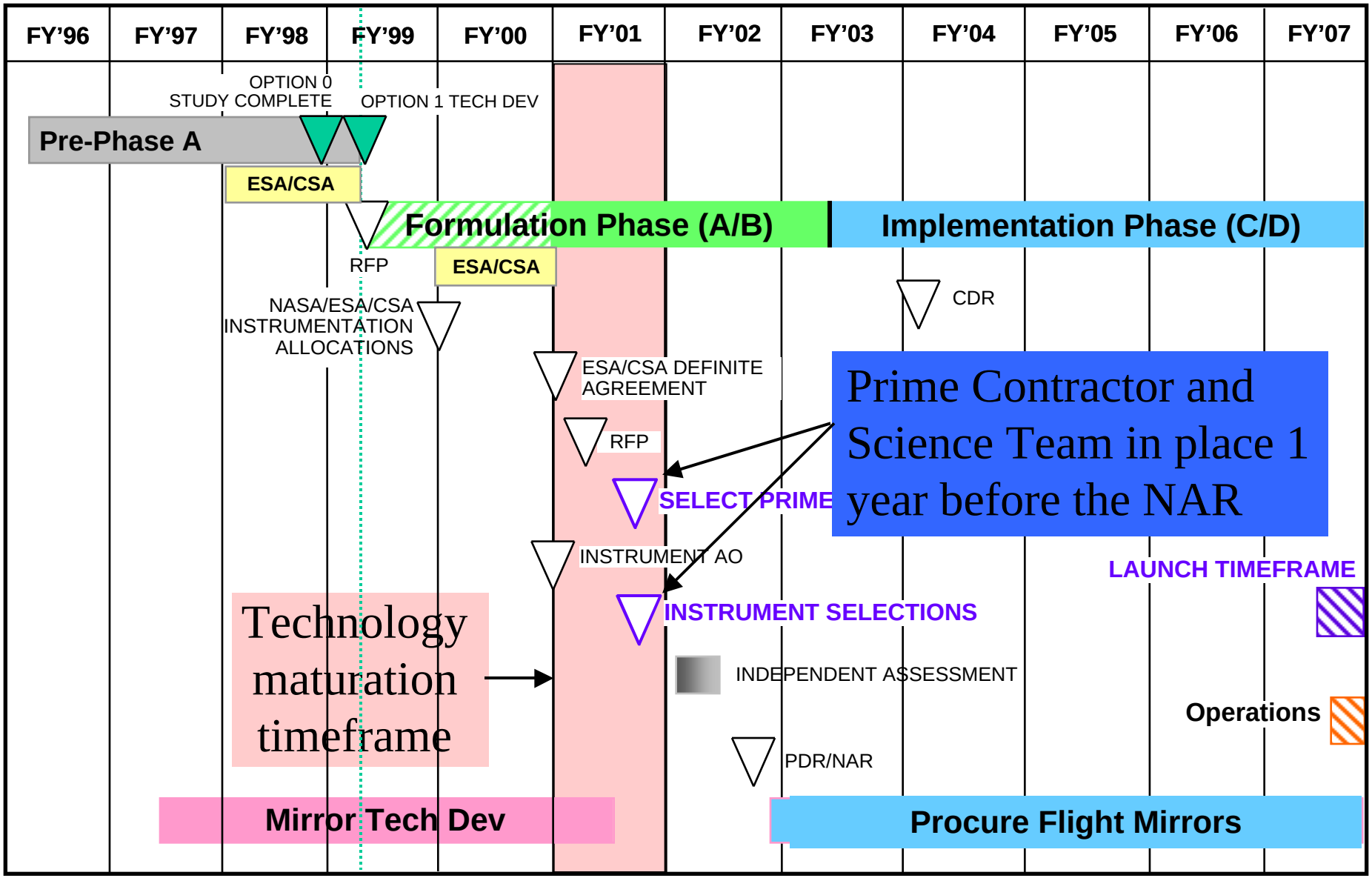
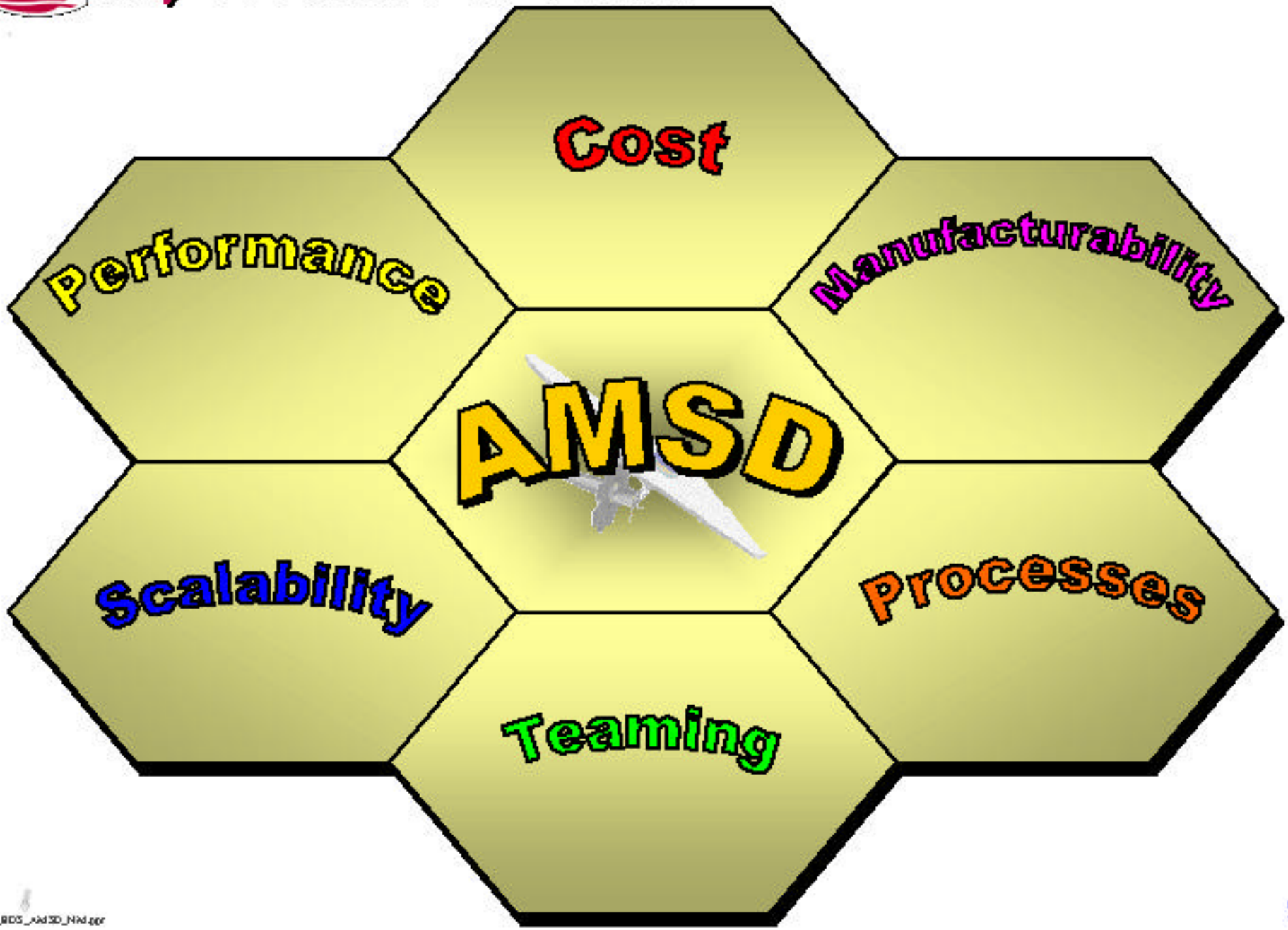
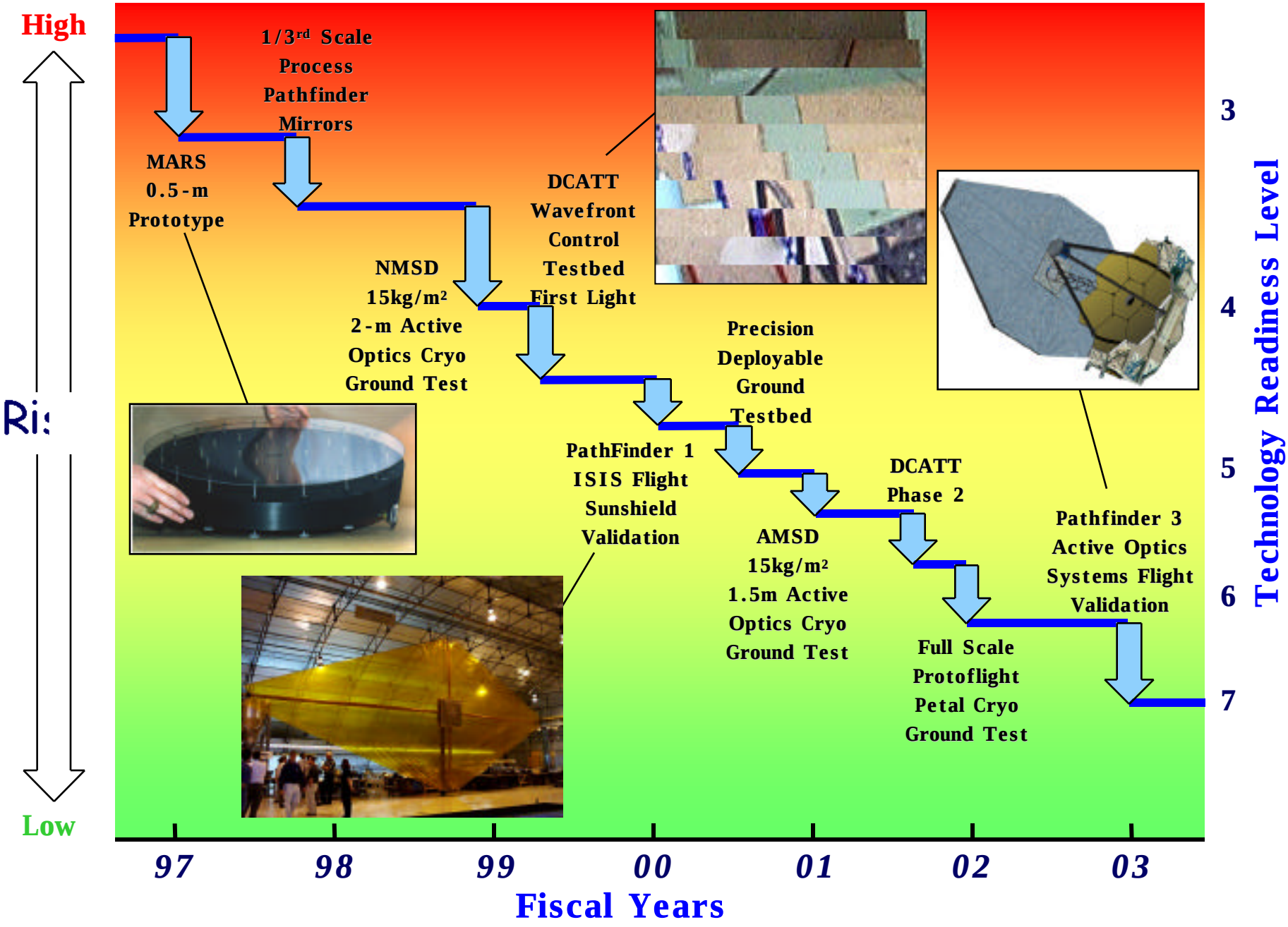
NGST Top Level Baseline Schedule
Progressive Downselect



Key Elements of AMSD



Telescope Technology Risk Mitigation Flow



NGST Science & Technology Challenges

- **September 13-17, 1999 Woods Hole, MA**
- **<u>Purpose:</u> Bring scientific and technology communities together at one conference for focused discussions of NGST relevant challenges**

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NGST Science & Technology Challenges

PRELIMINARY INFORMATION

Ultra Lightweight Space Optics Challenge Workshop

MARCH 24-25, 1999

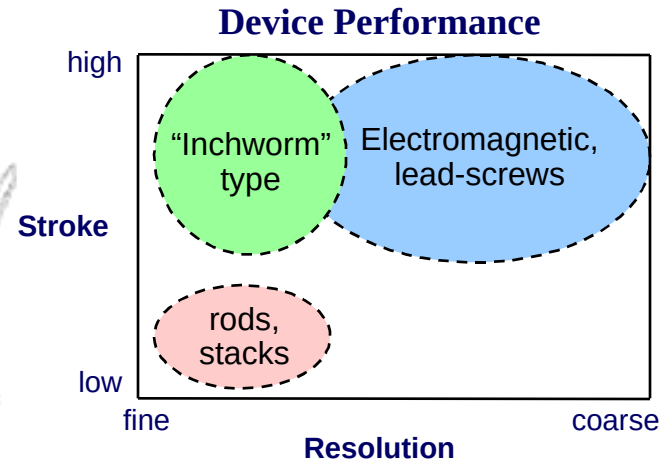
THE NAPA VALLEY MARRIOTT HOTEL,
NAPA, CALIFORNIA

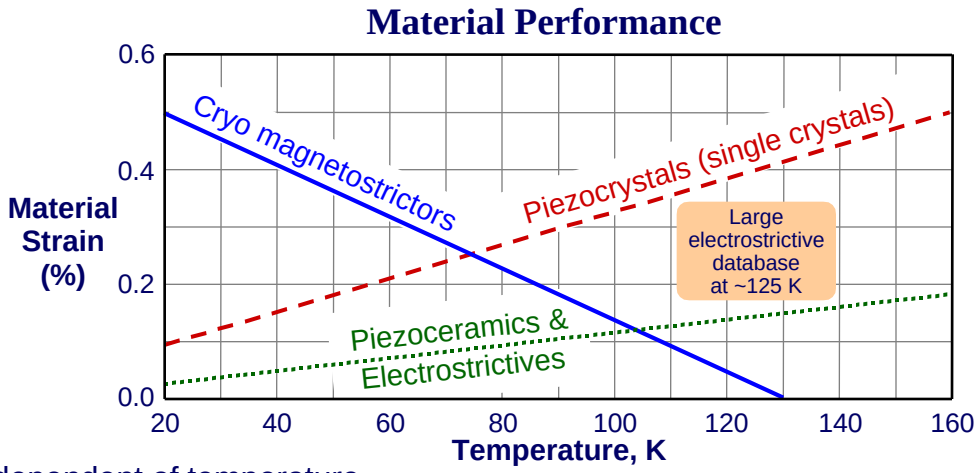
Sponsored by NASA, the Jet Propulsion Laboratory, the Goddard Space Flight Center and the George C. Marshall Space Flight Center

- **This meeting is a reconnaissance of the long-range technology challenges of the 20-40 meter class telescopes needed for NASA's Origins Program**
- **These systems include the Next-Next Generation Space Telescope and large optical interferometers designed to characterize extra-solar planets**
- **The objective is to provide a forum for technical interchange that will serve to steer NASA investments in existing, emerging and potentially feasible future ultra lightweight space optics technologies and optical system concepts**

Cryogenic Actuators

- **Use:**
  - Alignment of primary mirror segments & secondary mirror
  - Primary mirror segment figure control (if needed)
  - Deformable mirror (DM)
- **Key requirements:**
  - Stroke of several mm for position actuators, with resolution of 20 nm and power-off set and hold
  - Force actuators for figure control
  - Small stroke, 20 nm resolution for DM
  - Operation at 30 K (required) & room temperature (desired)
- **State of the art:**
  - No known actuator is available that satisfies the alignment actuator conditions in a single device
  - Picomotors have 30 nm resolution but do not operate cold
  - Piezoceramics & electrostrictive materials loose strain at low temperature





Electromagnetic actuator performance independent of temperature

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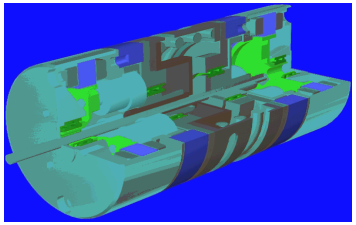
Cryogenic Actuators

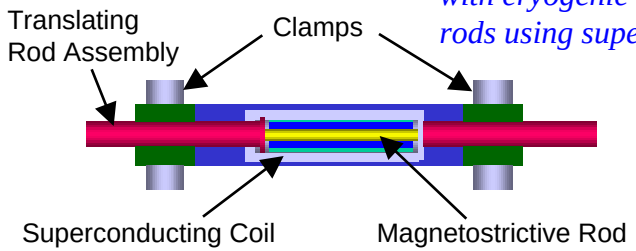
● AEHINC

Two-stage stepper motor/gear box concept



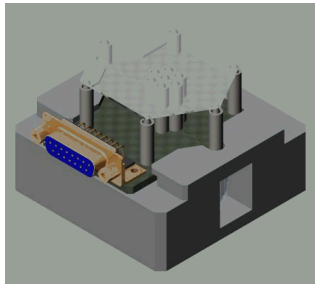
● Energen, Inc

Force & position actuator driven with cryogenic magnetostrictive rods using superconducting coils

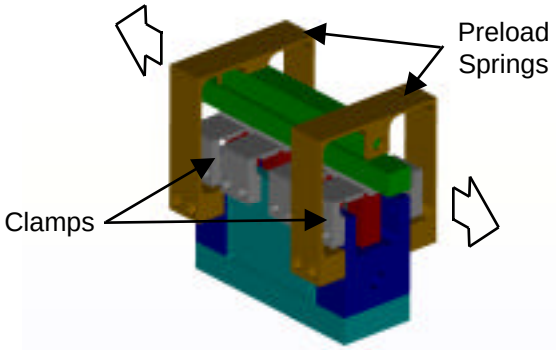


● American Superconductor

Hexagonal DM actuator array using cryogenic magnetostrictve rods with super conducting coils



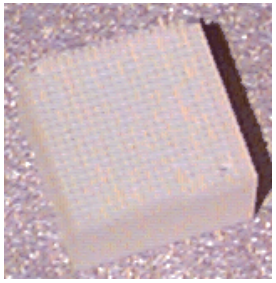
● Burleigh Instruments



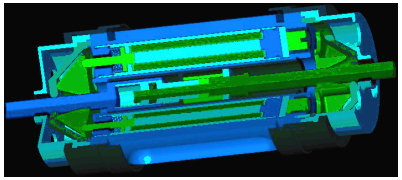
Inchworm™ linear motor driven with cryogenic piezoceramic stacks.

● Xinetics, Inc

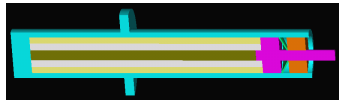
Modular DM actuator array features rods of single crystal or ceramic crystallites integrated into a monolithic module



● NASA LaRC



Linear stepper motor using piezocrystal stacks



Cryogenic Magnetostrictive rod driven with a high temperature superconductor

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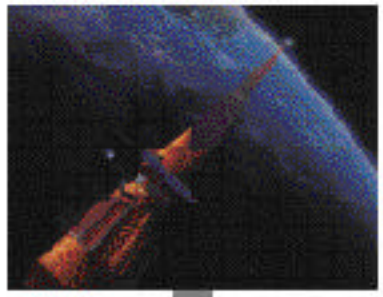
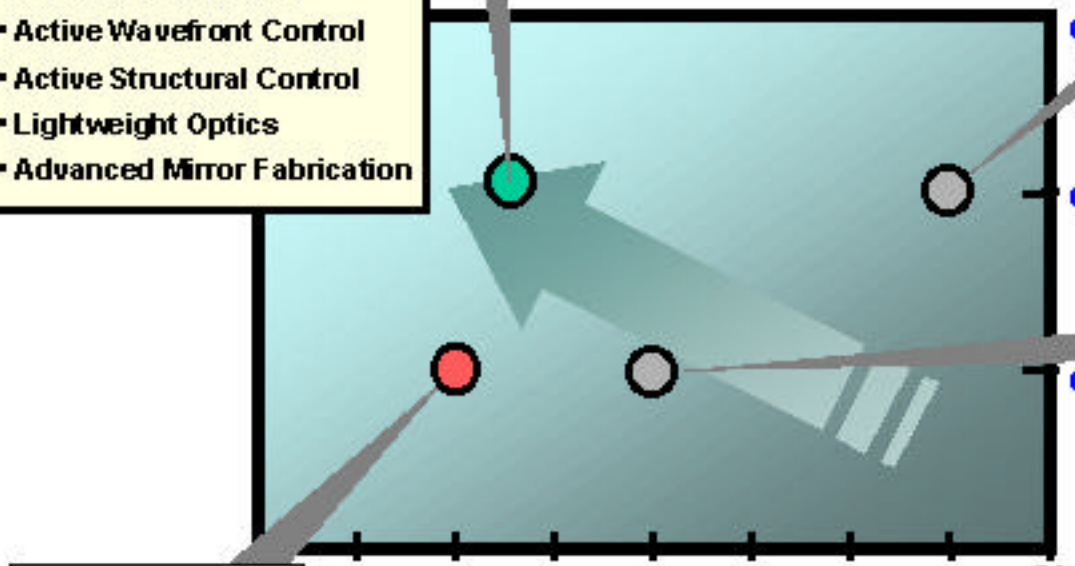
Large Optics Technology Design Space A Function of the Operational Environment



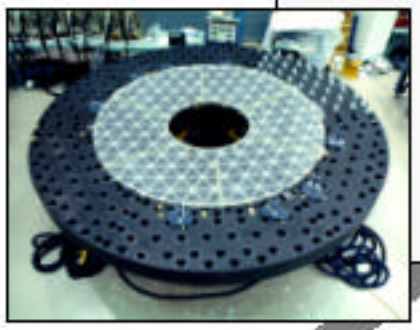
Critical Technologies

- Precision Structures
- Active Wavefront Control
- Active Structural Control
- Lightweight Optics
- Advanced Mirror Fabrication



Adaptive Large Optics Technologies Program (ALOT)

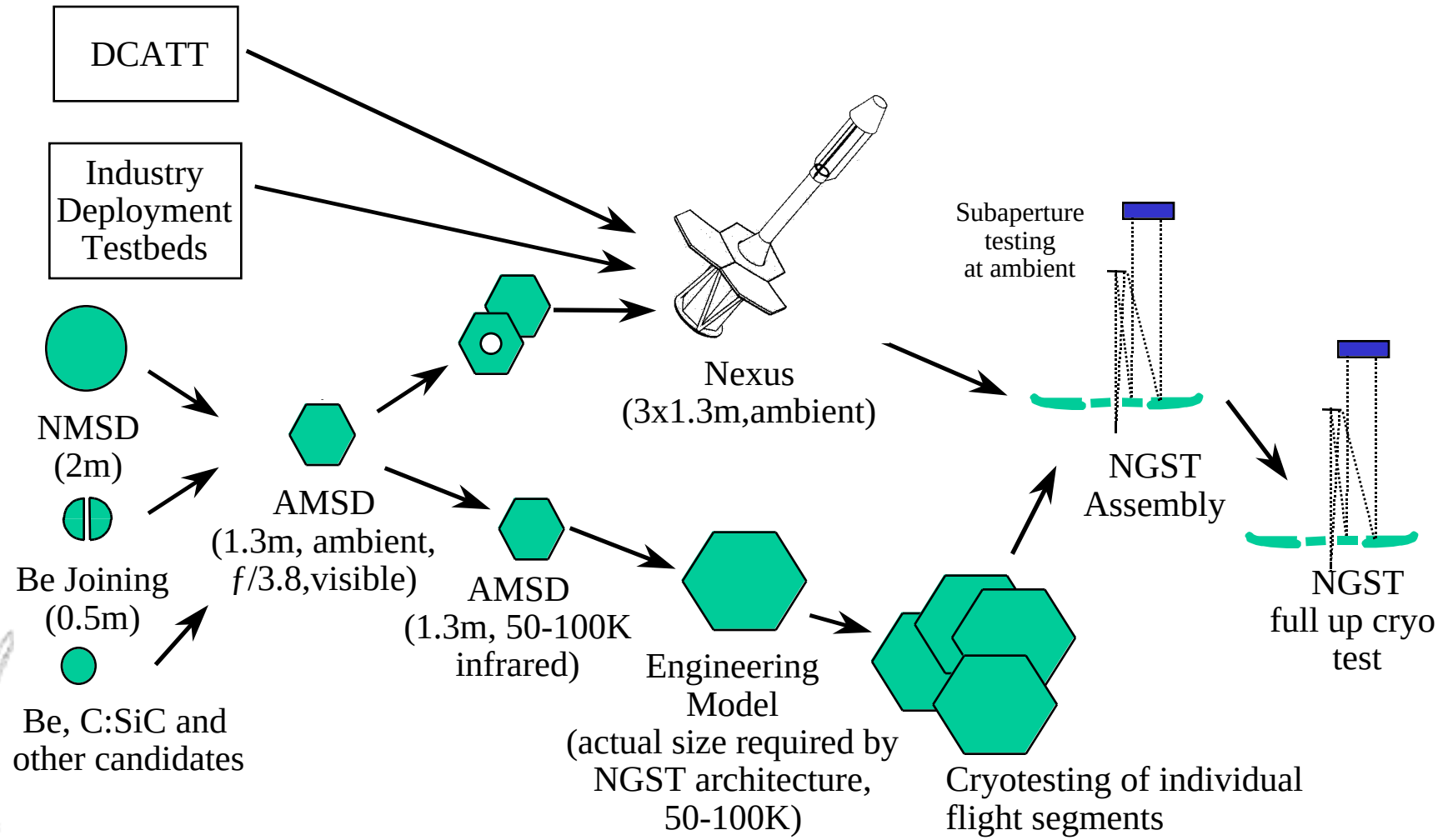
- 4m flight-like telescope with segmented primary mirror.
- ~70 kg/m²



High Altitude Large Optics (HALO)

- 3m diameter, 3 segment, mid-wavelength infrared primary mirror.
- 40 kg/m² (Not including integrating structure)

Mirror Development - Roadmap



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Telescope Risk Mitigation Strategy

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ACTIVE OPTICS

WAVEFRONT CONTROL